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Maternal and paternal parenting practices and their influence on children's adiposity, screen-time, diet and physical activity [☆]Adam B. Lloyd ^{a,b}, David R. Lubans ^{a,b}, Ronald C. Plotnikoff ^{a,b}, Clare E. Collins ^{a,c}, Philip J. Morgan ^{a,b,*}^a Priority Research Centre in Physical Activity and Nutrition, University of Newcastle, Callaghan, NSW, Australia^b School of Education, Faculty of Education & Arts, University of Newcastle, Callaghan, NSW, Australia^c School of Health Sciences, Faculty of Health, University of Newcastle, Callaghan, NSW, Australia

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ABSTRACT

The primary aim of this study was to examine a range of potential behavioral and maternal/paternal correlates of adiposity in children. Secondary aims were to examine (a) correlates of screen-time, diet and physical activity and (b) if there were differences in maternal and paternal physical activity- and dietary-related parenting practices. Cross-sectional analysis was conducted using 70 families with children (59% boys (41/70), mean age 8.4 (± 2.4) years). Parenting practices were measured using the *Parenting Strategies for Eating and Activity Scale*. Children's outcomes included: 7-day pedometry (physical activity), screen-time, percent energy from core foods (Food frequency questionnaire) and BMI z-score. Multiple regression models were generated to examine the associations between maternal and paternal parenting practices and children's variables. In the regression analyses, fathers' BMI ($p < .01$) and mothers' control ($p < .001$) were significantly associated with child weight status. Fathers' reinforcement ($p < .01$) was significantly associated with child physical activity. For screen-time, mothers' monitoring ($p < .001$) and child characteristics [age ($p = .01$), sex ($p = .01$), BMI z-score ($p = .03$)] were significant predictors. Mothers' parenting practices [limit setting ($p = .01$), reinforcement ($p = .02$)] and child screen-time ($p = .02$) were significantly associated with intake of core foods. Despite some similarities within families, three out of five parenting constructs were significantly different between mothers and fathers. Mothers and fathers have different parental influences on their children's weight status and lifestyle behaviors and both should be included in lifestyle interventions targeting children. A focus on maternal parenting specifically relating to screen-time and diet, and father's physical activity parenting and weight status may support their children in developing more healthy behaviors.

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Introduction

Pediatric obesity is associated with a range of adverse physiological and psychological health consequences (Dietz, 1998; Lobstein,

Baur, & Uauy, 2004) and studies have shown that excess weight in childhood is likely to track into adulthood (Biro & Wien, 2010). During the past three decades, childhood overweight/obesity rates have increased substantially in developed nations (Han, Lawlor, & Kimm, 2010) and prevalence is 21–25% in Australia (Olds, Tomkinson, Ferrar, & Maher, 2009). Modifiable obesity-related risk factors include high levels of screen-time, low levels of physical activity, low fruit and vegetable intake and high intakes of energy-dense, nutrient-poor foods (Birch & Ventura, 2009). However, internationally, studies have reported only a small percentage of children meeting guidelines for physical activity (Colley et al., 2011; Currie et al., 2008; Kohl et al., 2012; Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006; Sallis & Saelens, 2000), fruit and vegetable intake (Currie et al., 2008; Lock, Pomerleau, Causar, Altmann, & McKee, 2005; Magarey, Daniels, & Smith, 2001) and screen-time (Martin, 2011; Matthews et al., 2008; Salmon, Timperio, Telford, Carver, & Crawford, 2005; Sigman, 2012). In Australia, just under 50% of 5- to 10-year olds meet physical activity (PA) guidelines (Hardy, 2011) while dietary data indicate low levels of adherence to the Australian Dietary Guidelines for

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children (CSIRO, 2008). In the 9- to 13-year-old group, 51% meet the fruit recommendations and only 2% meet the serving recommendations for vegetables (≥ 2 –4 serves/day excluding potato) (CSIRO, 2008). In addition, the majority of children are exceeding the 2 hours recommended screen-time per day (Martin, 2011) which has been associated with increased BMI (Jago, Baranowski, Baranowski, Thompson, & Greaves, 2005) and the consumption of energy dense nutrient poor foods (Pearson & Biddle, 2011).

The importance of family and the household in shaping children's physical activity and dietary behaviors and weight status has been well established (Swanson, Studts, Bardach, Bersamin, & Schoenberg, 2011). Children are influenced by both their home physical and social environment which includes: their parents' modeling of specific behaviors, parenting style, parenting practices and beliefs, and social norms (Rhee, 2008). Furthermore, the family is critical to health behavior change (Gruber & Haldeman, 2009) with parents playing a major role in preventing and treating obesity in children, through their influence on their children's physical activity, eating behaviors (Patrick & Nicklas, 2005) and screen-time (Jago et al., 2011). In addition, there is evidence from systematic reviews to suggest that lifestyle intervention effectiveness can be enhanced by including parents (Dellert & Johnson, 2013; Golley, Hendrie, Slater, & Corsini, 2011; Kitzmann et al., 2010; McLean, Griffin, Toney, & Hardeman, 2003; Niemeier, Hektner, & Enger, 2012; van der Kruk, Kortekaas, Lucas, & Jager-Wittenaar, 2013); however, there is uncertainty around who and how to involve family members (Faith et al., 2012; Hingle, O'Connor, Dave, & Baranowski, 2010; O'Connor, Jago, & Baranowski, 2009; Van Lippevelde et al., 2012; Waters et al., 2011).

Parenting practices generally refer to the specific acts of parents when attempting to socialize their children (Patrick, Hennessy, McSpadden, & Oh, 2013), and can include social support and household rules concerning physical activity, screen-time and dietary intake. The association between parenting practices and child physical activity levels (Edwardson & Gorely, 2010b; Ferreira et al., 2007; Gustafson & Rhodes, 2006; Pugliese & Tinsley, 2007; Sallis & Saelens, 2000), diet (Pearson, Biddle, & Gorely, 2009; Rasmussen et al., 2006; van der Horst et al., 2007; Ventura & Birch, 2008) and screen-time (Hoyos Cillero & Jago, 2010) has been a focus of a number of systematic reviews. In a systematic review of parental influences on physical activity, Edwardson and Gorely (2010b) found that parents influence their children's physical activity through direct involvement, role modeling, encouragement and providing transport for organized physical activity. A positive association has also been demonstrated between child fruit and/or vegetable consumption and parenting practices through parental support for healthy eating (Rasmussen et al., 2006), family rules, home availability and parental encouragement (Pearson et al., 2009). In their review of screen-viewing (Hoyos Cillero & Jago, 2010) found that young children living with less parental screen-rules, more media access, or with parents with higher body mass indexes were more likely to have higher levels of screen-viewing. Demographic variables (ethnicity/nonwhite, age and lower socioeconomic status) were also consistently correlated with children's higher screen viewing (Hoyos Cillero & Jago, 2010).

Moreover, behavioral associations between parents and children's lifestyle behaviors also have been found for parents' and children's physical activity levels (Biddle, Atkin, Cavill, & Foster, 2011; Gustafson & Rhodes, 2006). In addition, consistent evidence exists for the association between parental fruit, vegetable and fat intake and that of their children (van der Horst et al., 2007).

Despite advances in our understanding of the parental correlates of children's lifestyle behaviors, previous research has mostly been from the mothers' perspective (Nicholson & Rempel, 2004; Rodenburg, Oenema, Kremers, & van de Mheen, 2013; Sleddens, Gerards, Thijs, de Vries, & Kremers, 2011). The lack of studies ex-

ploring paternal associations with children's behaviors is of concern given recent evidence highlighting the unique role of fathers in shaping children's dietary and physical activity habits (Biddle et al., 2011; FaHCSIA, 2009; Freeman et al., 2012; McIntosh et al., 2011; Morgan et al., 2011a) and recommendations from a recent systematic review to examine both mothers and fathers (Sleddens et al., 2012). There is limited research that has compared maternal and paternal activity related parenting practices (Davison, Cutting, & Birch, 2003; Edwardson & Gorely, 2010a), feeding practices (Blissett, Meyer, & Haycraft, 2006; Haycraft & Blissett, 2008; Loth, MacLehose, Fulkerson, Crow, & Neumark-Sztainer, 2013) or general parenting (Baxter & Smart, 2010).

There have also been recent calls in the literature for more research to examine potential differences in the influence of mothers' and fathers' parenting practices and behaviors on children's activity and dietary behaviors (Rodenburg et al., 2013). Including paternal and maternal variables in the same regression models allows researchers to assess if there is an 'independent' effect of fathers that is separate from the effect of mothers (Pleck, 2010). In a systematic review of the relationship between general parenting and children's weight status and lifestyle behaviors, it was recommended that larger samples of fathers were needed in studies to allow comparisons between mothers and fathers and to allow examination of differences in associations in child lifestyle behaviors, given the paucity of work in this area (Sleddens et al., 2011). These are problematic issues as fathers rarely participate in interventions or complete study measures and questionnaires (Sleddens et al., 2011).

To develop effective obesity prevention interventions for children, it is important to improve our understanding of how both parents influence their children's physical activity, dietary patterns and screen-time. Therefore, the primary aim of this study was to examine a range of potential behavioral and maternal/paternal correlates of children's adiposity. The secondary aims were (a) to examine correlates of children's screen-time, diet and objectively measured physical activity and (b) to examine if there were differences in maternal and paternal physical activity- and dietary-related parenting practices.

Methods

Study design

A cross-sectional analysis of baseline data from the Healthy Dads, Healthy Kids (HDHK) community effectiveness randomized controlled trial (RCT) (Morgan et al., 2011b) was conducted. Briefly, HDHK targets overweight fathers to lose weight and role model/positively influence their children's physical activity and dietary habits (Morgan et al., 2011a). The Human Research Ethics Committee of the University of Newcastle, Callaghan, New South Wales, Australia approved the study, and written informed father/mother consents and child assents were obtained for all participants.

Participants

A total of 93 men (aged 18–65 years) with children aged between 5 and 12 years were recruited for the RCT from two Local Government Areas (Singleton and Maitland) in New South Wales, Australia. The study protocol has been reported elsewhere (Morgan et al., 2011b). The inclusion criteria for the community RCT were: fathers' body mass index 25–40 kg/m²; no participation in other weight loss programs during the study; passing a health-screen (based on a questionnaire); and access to a computer with Internet facilities. Participants were recruited through a range of strategies including school newsletters, school-based presentations, advertisements on community notice-boards, and the local press. For the present study, families (n = 70) that had responses from both mother and father

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